One Earth
Primer

CellPress

Effectively Communicating Climate Science beyond Academia: Harnessing the Heterogeneity of Climate Knowledge

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https://doi.org/10.1016/j.oneear.2020.04.001

Approaches to communicating climate science beyond academia are necessary for enhancing salience, understanding, and engagement and accelerating action. This Primer discusses the heterogeneous manner in which climate change messaging is received by different audiences, how social scientific approaches could help to better tailor climate change messaging to this varied landscape, and how attempts to close this gap must consider the emotional and affective dimensions of climate messaging. We explore how the use of narratives can enhance effective climate science communication and emphasize the importance of evidence-based advocacy in the current era of global challenges, uncertainty, and post-truth.

The Challenge: High Salience but Low Engagement

People care about climate change. A series of recent surveys have shown that climate change is the second most important issue to people in the UK after Brexit (Climate Outreach 2019 survey) and that 60% of people think that addressing climate change requires a high or extremely high level of urgency (survey commissioned by the UK Centre for Climate Change and Social Transformation in August 2019). The data show that people are more worried now than they were 3 years ago, and most admit that their concern has grown significantly in the last year as a result of the increase in weather extremes, media reporting, and climate activism.

Yet, such concern and engagement with the issue are not met with sufficiently ambitious political action. Another survey conducted by Survation (not an environmental organization) in September 2019 found that a third of the British public thinks that greenhouse gas (GHG) emissions should be reduced to zero by 2025: 25 years ahead of the government's target of 2050. Over 30% think the target should be brought forward to between 2025 and 2050. However, half of the British public thinks it is unlikely that the British government will achieve its net-zero-emission target by 2050, suggesting a lack of trust in political leadership. People's lives will inevitably change as a result of climate change through responding to its impacts and the need to dramatically reduce carbon emissions. People will need to make changes in terms of behaviors, work practices, and levels of consumption. As we have seen recently during the COVID-19 pandemic, the choices people make will be guided by government regulations, social practices, and individual decisions, all of which will be shaped by the availability of information and the way in which it is communicated.

Improving the effectiveness of climate change communication means drawing on social science research and methods to a greater extent. In particular, recent work on the variety of factors that influence perceptions and attitudes toward climate change could prove to be a key tool in climate change communication. In doing so, a greater appreciation of the politics of objectivity in relation to scientific knowledge is key. In particular, it is crucial to understand what makes people listen to some views and not others and how this kind of authority varies between audiences. Nevertheless, making effective use of social science research means tackling the sometimes awkward epistemological disjuncture between natural and social scientific approaches. In particular, natural and social scientists must work together to consider how to align their messages to enhance public understanding and engagement.

This Primer will outline the challenges and opportunities of climate change communication in three parts. First, it will highlight the heterogeneous manner in which climate change messaging is received by different audiences. Second, it will consider the gap between knowledge and action and how understanding the emotional and affective dimensions of climate messaging could play a role in closing this gap. Third and finally, it will conclude by considering how narrative rather than "problem-solution" framings play an important role both in understanding counterclaims to climate science and in effectively messaging scientific results.

The Contested Politics of Scientific Objectivity

"Don't listen to me; listen to the science," entreats the iconic teen activist Greta Thunberg on a regular basis. And as usual, she's right. Cathartic though her exhortations of truth to power might be, she is merely the messenger of a scientific cannon honed by billions of hours of rigor, insight, and debate. Yet such lofty feats of human reason rest on the earthy foundations of the scientific method: repeatable experiments, testable hypotheses, and above all the undergirding maxim that is laid down on the foundation of the Royal Society and still adorns its crest today, *nullius in verba* (take nobody's word for it). Let evidence take precedence over even the most compelling orator or plausible opinion.

This concept of critical objectivity is so ingrained in the scientific approach as to form a key pillar of identity for many scientists.

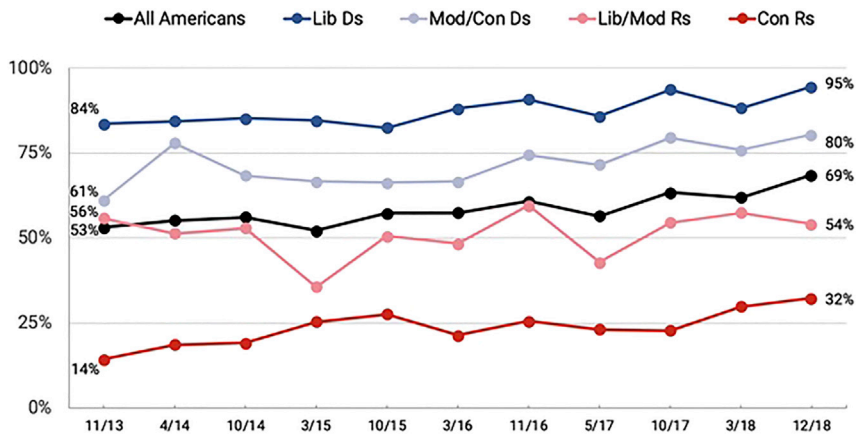

Figure 1. Five-Year Trend in the Proportion of Americans Very or Somewhat Worried about Global Warming
Reprinted from Gustavson et al., 2019.

Moreover, it is a position that has taken on new meaning in the era of climate change, extending beyond science and the academy as a clarion call amidst the white noise of post-truth. To back the science is to take the side of reason—to cut through the politics and posturing and stand firmly in the court of evidence.

Yet removed from the rarified clarity of the laboratory, the disinterest that underpins the scientific method rapidly evaporates. Translating the carefully nuanced conclusions of the laboratory into lay and policy language necessitates a goal quite opposite to *nullius in verba*: the crafting of an authentic, authoritative voice on whose word an audience will accept an argument without recourse to further evidence. This is a transition that must be managed with care so that a degree of underlying rigor survives it, yet no approach is without pitfalls. As the Intergovernmental Panel on Climate Change (IPCC) has discovered as its reports emerge in journalism, findings are often interpreted in interested ways without the "envelope" of definitions, caveats, and context that surround them in their original contexts and are newly imbued with microcosmic positionalities.

Ever since the "Africagate" and "Amazongate" allegations of improper referencing and unsubstantiated claims levelled against the IPCC's Fourth Assessment Report (AR4) in 2007, climate scientists have been well aware of the ease with which politicized misinterpretation can drown out even the weightiest tomes of expertise. Soon after, the Tyndall Centre email hack in 2009 saw a single phrase—"Mike's trick," referring to the graphical transition from tree ring to thermometer data in Michael Mann's 1999 hockey-stick graph—undermine a global green movement with false allegations of scientific conspiracy. It would be almost a decade before overall public "belief" in anthropogenic climate change recovered to the levels of 2009.

However, problematic as such issues are for the public understanding of climate change, they are in reality the tip of the iceberg. As exemplified almost daily in relation to climate change, judgments over whose knowledge is worthwhile and whose is not are highly political acts. The proportion of those who "believe" in anthropogenic climate change and the seriousness of its impacts varies both according to country—and the prevailing national environmental discourse therein—and according to demography. In the US, for example, as shown in Figure 1, there is a 63-point difference between the most conservative Republicans (32%) and the most liberal Democrats (95%) claiming to be "somewhat" or "very" worried about climate change. Gender and race, similarly, are significant and consistent predictors of attitudes to climate change, leaving the conservative white male as an outlying—albeit disproportionately influential—low point in the data.

Climate science in the world at large is therefore a hotly contested arena. Yet rather than being stymied by this diversity, communicators of climate change must embrace it and recognize that multiple approaches could be necessary for conveying ideas to a broad audience. In order to achieve this, climate change communicators must cultivate a renewed respect for the words long disavowed by the scientific method. Social science has only recently begun in earnest to get to grips with how climate change is affecting society, but its arrival, though late, has been fruitful. In particular, recent work on climate anxiety, climate change perception, and climate change denial have brought a nuanced conception of the public understanding of science. Effective climate change communication means harnessing the value of work in psychology, geography, sociology, and other disciplines in an active, as well as descriptive, sense.

However, doing so will require a realignment of the politics of objectivity surrounding climate change. Long concerned with the production of irrefutable evidence capable of withstanding the rigors of a hostile environment, the improvement of climate change messaging requires a shift in emphasis. Rather than being bearers of a single objective truth, climate scientists and their communicators will need increasingly to acknowledge the subjectivities—including their own—that shape the perception of climate science. Rather than decrying their deviation from core scientific messaging, they must bring these complex, heterogeneous, and subjective interpretations of science within its wider rubric. As in all aspects of communication, "one size fits all" is rarely effective.

Climate science must instead embrace the multiplicity of its own interpretation by recognizing that science sounds different to each listener and tailoring its messages accordingly. Those most capable of understanding scientific evidence as intended are also the most likely to be sympathetic to it, yet targeting this group alone will effect little attitudinal change. What might an effective climate change communication look like to those most skeptical of climate science? How, by contrast, might the same message be best communicated to those of different ethnic or cultural backgrounds? If a significant shift is possible in the contemporary politics of climate change, these questions will be at the forefront of efforts to instigate it.

International Guidance and the Importance of Emotions

Communicating climate change is a key aspect of climate change governance at all levels. The UN Framework Convention

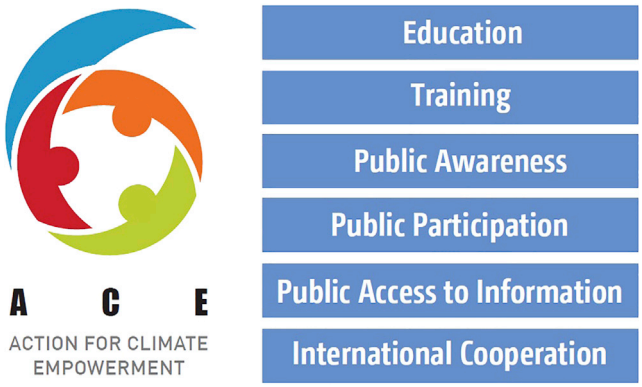

Figure 2. Diagram Depicting the Six Elements of Action for Climate Empowerment (Article 6 of the UNFCCC Convention)
Reprinted from United Nations Framework Convention on Climate Change, 2020.

on Climate Change (UNFCCC), which facilitates governmental negotiations on climate change, also recognizes the importance of engaging the public and empowering citizens at all levels to contribute to tackling the climate crisis. This is emphasized in Article 6 of the UNFCCC Convention (1992) and reiterated in Article 12 of the Paris Agreement (2015), although it is referred to as the more catchy Action for Climate Empowerment (ACE). ACE incorporates six elements, as depicted in Figure 2.

UNFCCC policy mandates that governments engage the public through these six, equally important avenues. This is based on a normative goal for citizens to supplement government action while also encouraging decision makers to commit to more ambitious policies. After decades of climate change communication, it has become clear that if mass mobilization is the goal, awareness raising through dissemination of scientific knowledge isn't enough, even though it might be the simplest to facilitate. The problem is not a knowledge deficit, particularly in Europe and the US, where there have been a large number of campaigns on climate communication and outreach. Climate change skepticism is low, public awareness of and concern about climate change is high, and surveys in many countries have shown high levels of support for climate change policies, such as the deployment of renewable energy and reforestation. Despite this widespread support for climate action, behavioral change remains low. This is partly attributable to the failure of climate change scientists, concerned politicians, and practitioners to communicate climate change in a way that resonates with and empowers a wider audience.

Each year since 2013, the UNFCCC has facilitated a dialog between policymakers, researchers, and practitioners during the "intersessional" climate change negotiations. In these interactive workshops, a number of experts from around the world have shared advice and best practices on how to enhance communication and engagement. They have highlighted several barriers to public awareness, such as a lack of funding for climate communications and the spread of misinformation, and have also identified various solutions. These include the importance of communicating solutions as well as problems, tailoring communication to specific audiences, and engaging people with narratives rather than statistics. These latter points were particularly emphasized by the UK organization Climate Outreach. They have created a range of publications on communicating with different audiences, such as 18- to 25-year-olds, the political center-right, and members of the five major faiths. They have also created a communication guide specifically for climate scientists from the IPCC. In this they highlight the importance of communicating authentically in order to be trusted as a messenger by relating discussions to people's past experience and highlighting the relevance of problems to people's daily lives. They also emphasize the power of storytelling to ensure that messages resonate with people's diverse values and emphasize scientific consensus while carefully explaining uncertainty and the scientific method.

Youth participants in the ACE dialogs have highlighted that their concerns are increasing as communities around the world experience extreme weather conditions and as climate change projections indicate dangerous runaway climate change, yet climate policies remain limited and insufficiently ambitious. Eco-anxiety is on the rise, and mental-health issues connected to climate change are increasing. Maria Ojala, associate professor of psychology at Örebro University in Sweden, has found that many young people feel pessimistic and unempowered about climate change, even in developed countries such as Sweden, as they experience a combination of worry for the future and guilt for being in countries more responsible for GHG emissions. Rather than being concerned with the risks to their own lives, youths express worry about impacts on future generations and vulnerable communities around the world. However, this could be partly a psychological response to distance themselves from the problem by framing it as removed from space and time.

Ojala emphasizes the importance of intergenerational communication on climate change to alleviate these worries, particularly given that fear is compounded by the "spiral of silence" when climate change isn't openly and frequently discussed. As such, it is necessary to promote hope rather than worry, and this needs to be constructive and solution oriented. This creates an additional challenge for the climate change communicator: ensuring that individuals aren't overwhelmed by the scale and severity of the challenge faced.

Decades of psychological research have explored the conditions under which it is acceptable to use negative messaging to change people's behavior and have concluded that frightening messages need to be made personal and manageable and need to present clear solutions to remove the threat, e.g., "take this vaccine (or engage in social distancing) to reduce your chance of getting it" versus "this disease is horrible." Although recent movements such as Extinction Rebellion have mobilized many people by using fearful messages, this needs to be coupled with tangible solutions to prevent the public from slipping into apathy or denial. Despite widespread awareness of climate change, behavioral change remains low because of a lack of clear ways in which individuals and communities should react. Many accept that climate change is a problem, but the question that remains on their lips is, "what can I do about it?"

As trusted messengers, climate scientists can reassure others by being seen as doing their part, combatting the spiral of silence and perceptions of widespread inaction by sharing positive examples, and promoting opportunities to engage in tangible solutions.

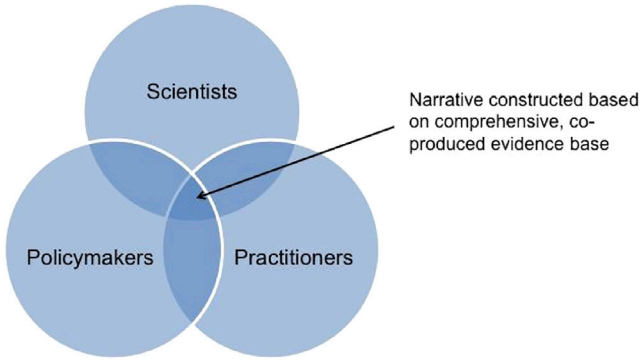

Figure 3. Narrative Construction Based on the Consolidation and Negotiation of a Co-produced Evidence Base by Scientists, Policymakers, and Practitioners
Adapted from Viner and Howarth, 2014.

Tailoring Communication: A Space for Narratives

When it comes to communicating climate change to non-expert audiences in a way that ensures the consideration of what is right and what is wrong, some basic principles of science need to be considered (see Mertonian norms). There is a need to understand that science follows communalism (that scientific knowledge is a result of social collaboration and is thus commonly owned by the whole scientific community), universalism (that scientific evidence is objective and independent of its discoverer's personal or social attributes), disinterestedness (that science is unbiased and should not be pursued for personal gain and is accountable to scientific peers), and organized skepticism (that, by nature, science is consistently and routinely questioned and verified with a temporary suspension of judgment). This can be taken for granted particularly for scientific issues that are contentious and question our current and future ways of structuring and running our lives.

This applies well to contexts where scientists are communicating within their own discipline; however, scientists tend to find that they are not well prepared, equipped, or incentivized to communicate to non-specialist audiences. This is problematic particularly when local framings of climate change are known to increase engagement, yet platforms and processes in place to facilitate knowledge exchange and science communication at this level are not effective. Similarly, science informs climate change action and practice on the ground; however, the disconnect between science and practice means that barriers hinder progress based on up-to-date evidence. As an example, large evidence-assessment reports such as the IPCC and UK Climate Change Risk Assessment lack sufficient granularity to adequately and constructively inform climate action on the ground.

When the audience is government and policymakers, the needs for climate change information and evidence are specific: evidence must be accurate, up to date, and rapidly evolving to address the reactive and responsive nature of policymaking. Scientists dedicate often significant periods of time to exploring and analyzing a particular problem to ensure that a rigorous, robust, and ethically sound process is in place to guarantee that an unbiased and value-free scientific outcome is achieved. This can conflict, however, with the policy world, where time is limited and where decisions are made quickly on the basis of the best evidence available and are often not value- or context-free. This misalignment means that communication on climate change can lack sufficient focus, timeliness, and relevance to be of use to decision making.

We know that individuals use their cultural and political viewpoints to filter information on climate change, which enables them to weigh the risks of climate change and the available solutions. There is an over-reliance on a linear flow of information where a "problem-solution" approach is adopted and where it is assumed that providing information about climate change therefore isn't enough to help reduce GHG emissions through behavioral change. Therefore, rather than fixating on gaps in knowledge or polarized arguments, a focus on where there are overlaps in perceptions and motivations provides a more constructive way to engage with the issue and have more constructive dialog on what is needed for societal shifts.

Narratives, for example, are an effective way of engaging audiences and telling stories on issues that could be difficult to engage with and to link to an audience's social context. Narratives help increase connection between people and give meaning to certain issues, and they enable audiences to make sense of complex issues. They are useful ways of enhancing local knowledge, understanding, and engagement with climate change and can enable a better connection to climate change solutions (Figure 3). They can act as effective tools for synthesizing scientific evidence and consolidating with expertise from policymakers and practitioners to form an engaging, comprehensive, and actionable evidence base. Politicians use them to engage their constituents, as do teachers with their students, enabling a better connection between theoretical and experiential experiences. Narratives can be built in a number of ways depending on the issue in question, the purpose of the narrative, and the audience-messenger interface. They help frame complex and challenging societal issues such as climate change in a way that aligns and resonates with people's values and builds on what climate change impacts and solutions mean to them. In so doing they provide an effective way of increasing engagement and action on climate change through a story-like depiction of a complex and emotionally loaded issue.

Looking Forward: Enhancing Climate Communication

Communication of (climate) science alone, and increasing awareness about climate change, is not enough to instigate action. This needs to go beyond presenting facts and data to ensure that it aligns closely with the values, beliefs, and interests of specific audiences. Asking "who is this for?" is a first question to answer when communicating science; this will enable a closer tailoring of the message and ensure that salience to the issue is as high as possible. This can be done through directly addressing any perceived barriers to change that exist and enabling a more positive vision of what a low-carbon future looks like, for example, by demonstrating the benefits (e.g., financial, co-benefits, and quality of life) and opportunities from a low-carbon future, how this will still enable people to maintain independence and freedom of choice, how a transition to a low-carbon future can have relatively limited

disruptions if carefully crafted, and what the implications of not shifting might be.

Crucially, communication of climate change, as challenging as it can be, must consider both mitigation of climate change and adaptation to the current and future climate impacts. Too often are mitigation and adaptation efforts conducted in siloes, partly because of the way in which the science of mitigation and adaptation is conducted as well as the lack of alignment and messaging on climate change.

Moreover, it is of equal importance to recognize that climate science takes place within this context. In order to effectively communicate scientific messages about climate change, we must recognize the role of politics in shaping both dissemination and comprehension. From media misdirection to prioritization of scientific funding, such articulations reshape the boundaries of scientific knowledge by shifting the borders between objectivity, debate, and opinion. When scientific communications are made, this complex milieu acts as a prism to refract the initial message into multiple distinct receptions.

Historically, this phenomenon has often stymied the effectiveness of climate change communication, yet it could just as easily be an asset. To ensure that scientific messaging is effectively carried out in practice (and strategies are enhanced in theory) and in order to constructively inform conversations and decision making, we need the following approaches:

- We need to rely on science, communicated and conveyed in a compelling and relatable way. Yet, we cannot expect that all members of an audience will receive and understand science in the way it is intended.
- Communication needs to consider what the audience cares about and is interested in and help connect the issue to these things. In particular, we need to recognize that the same message will be received differently by different audiences and craft multiple messages to achieve the same effect across a broad range of positionalities.
- Communication must move away from scientific jargon, facts, and figures, and having a trusted messenger will ensure that conversations are a two-way dialog.
- Climate change evokes a range of beliefs, emotions, and feelings; therefore, moving away from making people feel fearful to highlighting the benefits associated with the changes needed in their lifestyles is core to ensuring long-term engagement and action.
- Narratives can help overcome perceived barriers to change and enable a better appreciation of the audience's interpretation of information on climate change, as well as a better incorporation of the context of communication, while anticipating potential misinterpretation of communication and delayed decision-making processes.
- We need to identify the current barriers that are stopping people, organizations, institutions, and governments from making these changes and then see them as opportunities to instigate change that aligns with their needs.

ACKNOWLEDGMENTS

The authors appreciate support from the Royal Geographical Society Climate Change Research Group, the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science, the Priestley International Centre for Climate at the University of Leeds, and the UK Economic and Social Research Council Place-Based Climate Action Network (PCAN) (ref. ES/S008381/1).

RECOMMENDED READING

Corner, A., and Groves, C. (2014). Breaking the climate change communication deadlock. Nat. Clim. Chang. *4*, 743.

Corner, A., Shaw, C., and Clarke, J. (2018). Principles for Effective Communication and Public Engagement on Climate Change: A Handbook for IPCC Authors (Climate Outreach).

Fischhoff, B. (2013). The sciences of science communication. Proc. Natl. Acad. Sci. USA *110*, 14033–14039.

Goodwin, J., and Dahlstrom, M.F. (2014). Communication strategies for earning trust in climate change debates. Wiley Interdiscip. Rev. Clim. Change *5*, 151–160.

Gustafson, A., Bergquist, P., Leiserowitz, A., and Maibach, E. (2019). A Growing Majority of Americans Think Global Warming Is Happening and Are Worried (Yale University and George Mason University (Yale Program on Climate Change Communication)).

Hine, D.W., Reser, J.P., Morrison, M., Phillips, W.J., Nunn, P., and Cooksey, R. (2014). Audience segmentation and climate change communication: conceptual and methodological consideration. Wiley Interdiscip. Rev. Clim. Change *5*, 441–459.

Howarth, C. (2017). Telling stories on climate change and low carbon futures: framing narratives around the UK's fifth carbon budget. J. Energy Res. Soc. Sci. *31*, 295–302.

Howarth, C. (2019). Resilience to Climate Change: Communication, Collaboration and Co-production (Palgrave Pivot).

Hulme, M. (2009). Why We Disagree about Climate Change: Understanding Controversy, Inaction and Opportunity (Cambridge University Press).

McCright, A.M., and Dunlap, R.E. (2011). Cool dudes: the denial of climate change among conservative white males in the United States. Glob. Environ. Change *21*, 1163–1172.

Meyers, T., Nisbet, M., Maibach, E., and Leiserowitz, A. (2012). A public health frame arouses hopeful emotions about climate change. Clim. Change *113*, 1105–1112.

Moser, S.C. (2010). Communicating climate change: history, challenges, process and future directions. Wiley Interdiscip. Rev. Clim. Change *1*, 31–53.

Nerlich, B., Koteyko, N., and Brown, B. (2010). Theory and language of climate change communication. Wiley Interdiscip. Rev. Clim. Change *1*, 97–110.

Ojala, M. (2018). Eco-anxiety. RSA J. *164*, 10–15.

Pearson, A.R., Ballew, M.T., Naiman, S., and Schuldt, J.P. (2017). Race, class, gender and climate change communication. In Oxford Research Encyclopaedia of Climate Science, H. Von Storch, ed. (Oxford University Press).

Pidgeon, N., and Fischhoff, B. (2011). The role of social and decision sciences in communicating uncertain climate risks. Nat. Clim. Chang. *1*, 35–41.

Rapley, C., de Meyer, K., Carney, J., Howarth, C., Clarke, R., Smith, N., Stilgoe, J., and Youngs, S. (2014). Time for a change? Climate science reconsidered: a policy briefing on the report of the UCL Policy Commission on the communication of climate science (UCL Public Policy).

Shapin, S. (2010). Never Pure: Historical Studies of Science as if It Was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority (JHU Press).

United Nations Framework Convention on Climate Change (2020). What is action for climate empowerment?. https://unfccc.int/topics/education-youth/the-big-picture/what-is-action-for-climate-empowerment.

Viner, D., and Howarth, C. (2014). Practitioner's work and evidence in IPCC reports. Nat. Clim. Change *4*, 848–850.

Wolf, J., and Moser, S.C. (2011). Individual understandings, perceptions, and engagement with climate change: insights from in-depth studies across the world. Wiley Interdiscip. Rev. Clim. Change *2*, 547–569.